

Patent Claims

1. An apparatus for producing alcohol from plant raw materials, comprising
 - 5 - a fermentation station (13) which ferments liquefied raw material to mash,
 - a distillation station (15) separating off the alcohol from the mash and
 - 10 - a drying station (21, 31) for vinasse arising in the distillation station (15),characterized in that
for the production of alcohol from cereals, a grinding station (1) which grinds to flour the grain comprising the starch and/or sugar of the
15 cereals with the separation of at least a part of the seed coat portions enclosing the grain, and a liquefaction station (9) digesting the flour are provided and in that the seed coat portions which are separated off can be fed to the drying station
20 (21, 31) as carrier medium for the vinasse drying.
2. The apparatus as claimed in claim 1, characterized in that the grinding station (1) separates off the seed coat portions in a weight ratio of seed coat
25 portions to flour of 1 to 9 to 2 to 8.
3. The apparatus as claimed in claim 1 or 2, characterized in that the grinding station (1) grinds the cereals to flour with a mean particle
30 size between 0.5 and 1 mm.
4. The apparatus as claimed in one of claims 1 to 3, characterized in that the grinding station (1) has a roller mill or an impact jet mill.
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5. The apparatus as claimed in one of claims 1 to 4 or in the preamble of claim 1, characterized in that, for producing alcohol from plant raw

materials, in particular cereals ground to flour, a liquefaction station (9) digesting carbohydrates and/or sugars in the raw material is provided, which has a mixing condenser (53) admixing steam to the product stream of the comminuted raw material or a suspension thereof, at least one mixing stage comprising mixing condenser (53), a steam-jet injector (57) downstream of the mixing condenser (9) and admixing superheated steam to the product stream, and an expansion cooler (63) for the product stream connected downstream of the steam-jet injector (57) and comprises at least one expansion stage (67, 73), the mixing condenser (53) admixing expansion vapor of the expansion cooler (63) to the product stream.

6. The apparatus as claimed in claim 5, characterized in that at least the expansion cooler (63) is of multistage construction and the mixing condenser (53) admixes to the product stream at least the expansion vapor of the first expansion stage (67) of the expansion cooler (67).

7. The apparatus as claimed in claim 6, characterized in that the mixing condenser (53) is of single-stage construction, and the expansion cooler (63) is of two-stage construction.

8. The apparatus as claimed in one of claims 5 to 7, characterized in that the mixing condenser (53) heats the product stream to a temperature below the gelatinization temperature of the raw material, and the steam-jet injector (57) heats the product stream to a temperature above the gelatinization temperature of the raw material.

9. The apparatus as claimed in one of claims 1 to 8 or the preamble of claim 1, characterized in that,

- between the fermentation station (13) and the distillation station (15), there is disposed a degassing station (17) in which the mash product stream passes through from top to bottom a vertically standing tube bundle (81) which is evacuated at its bottom end, and the mash product stream expands in the tube bundle (81).
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10. The apparatus as claimed in claim 9, characterized in that the mash product stream, before entry into the tube bundle (81), passes through a heat exchanger (79) preheating the mash.
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11. The apparatus as claimed in one of claims 1 to 10 or the preamble of claim 1, characterized in that the drying station (21, 31) comprises a drier (21) which carries out the final drying of the vinasse with a dew point temperature of above 95°C, preferably 100°C to 105°C, and in that the distillation station (15) comprises a distillation column (91) heated by the exhaust vapor of the drier.
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12. The apparatus as claimed in claim 11, characterized in that the drier (21) produces essentially air-free exhaust vapor.
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13. The apparatus as claimed in claim 11 or 12, characterized in that the drier (21) is constructed as a superheated steam drier.
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14. The apparatus as claimed in one of claims 1 to 13 or the preamble of claim 1, characterized in that the distillation station (15) has a first distillation column (91) which is heated, in particular, by exhaust vapor of the drying station (21, 31), to which is connected a dehydration station (45) which dehydrates its crude alcohol product stream
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and in that a second distillation column (117) is connected at an intermediate level of the first distillation column (91) above its mash feed level (93), which second distillation column is heated via a heat exchanger (127) by heat of the dehydrated alcohol vapor of the dehydration station (45).

15. The apparatus as claimed in claim 14, characterized in that the heat exchanger is constructed as a falling-film evaporator (127) heated by dehydrated alcohol vapor of the dehydration station (45).

16. The apparatus as claimed in claim 14 or 15, characterized in that the dehydration station (45) comprises a molecular sieve (117).

17. The apparatus as claimed in claim 16, characterized in that the molecular sieve (117) is operated at a pressure of 1.7 bar absolute or more.

18. The apparatus as claimed in one of claims 1 to 17 or the preamble of claim 1, characterized in that the drying station (21, 31) comprises a separator (25) which separates the vinasse into a vinasse-thin juice product stream and a vinasse-solids product stream, an evaporator (31) which evaporates the vinasse-thin juice product stream to form vinasse-thick juice, and also a drier (21) which dries the vinasse-thick juice together with the vinasse-solids to give dry vinasse, in that the distillation station (15) is connected downstream of the dehydration station (45) which dehydrates the crude alcohol product stream and in that the evaporator (31) has at least one evaporator stage (51) heated by heat of the

dehydrated alcohol vapor of the dehydration station.

- 5 19. The apparatus as claimed in claim 18, characterized in that the evaporator (31) comprises a pre-evaporator (49) and a final evaporator (51) and in that the final evaporator (51) is heated by dehydrated alcohol vapor from the dehydration station (45).
- 10 20. The apparatus as claimed in claim 18 or 19, characterized in that the dehydration station (45) comprises a molecular sieve (117).
- 15 21. The apparatus as claimed in claim 20, characterized in that the molecular sieve (117) is operated at a pressure of 1.7 bar absolute or more.